Claims:

1. A process for the manufacture of carbon nanostructures, the carbon nanostructures being selected from carbon nanotubes and carbon nano-onions, the method comprising the steps of injecting a carbon-containing gas into a plasma flame generated from a plasma forming gas to provide atomic carbon, which in the presence of in situ generated nanometer sized metal catalyst particles that act as nucleation points for growth of carbon nanostructures, produce the carbon nanostructures, and collecting the carbon nanostructures.

2. A process as claimed in claim 1 wherein the carbon-containing gas is injected together with a carrier gas.

3. A process as claimed in claim 2 wherein the carrier gas and the plasma forming gas are each selected from helium, argon, nitrogen and air, and they are the same or different.

4. A process as claimed in claim 1 wherein a high enthalpy plasma torch is used to generate the plasma and a nozzle is attached to a torch outlet for injection of the carbon-containing gas.

5. A process as claimed in claim 1 wherein an inductively coupled thermal plasma torch is used to generate the plasma and an injection probe is used within the plasma region for injection of the carbon-containing gas.

6. A process as claimed in claim 4 wherein the carbon-containing gas is tetrachloroethylene.

7. A process as claimed in claim 4 wherein an electrode generates the metal vapor in the plasma torch which metal vapor nucleates into nanoparticles in the zone of nanostructure formation.

8. A process as claimed in claim 7 wherein the electrode is selected from iron, tungsten, nickel, cobalt, chromium, molybdenum, palladium, platinum, ruthenium, rhodium, hafnium, gadolinium electrodes and combinations thereof or copper electrodes coated with one or more of such metals.

9. A process as claimed in claim 7 wherein a tungsten electrode is used.

10. A process as claimed in claim 9 wherein a tungsten nozzle is used.

11. A process as claimed in claim 7 wherein the amount of catalyst nanoparticles and of carbon-containing gas are controlled independently.

12. A process as claimed in claim 11 wherein the metal vapor content in the plasma is controlled by the electric arc current in the plasma torch and the quantity of carbon in the system is controlled by the carbon source gas volumetric flow.

13. A process as claimed in claim 1 wherein the catalyst is derived from at least one metal powder injected into the outlet flame of the torch.

14. A process as claimed in claim 1 wherein the catalyst is generated from droplets of metal generated from a metal sample brought into contact with the flame.

15. A process as claimed in claim 1 wherein the catalyst is externally generated from supplying metal vapor or nanoparticles from a metal evaporator.

16. A process as claimed in claim 1 wherein the catalyst is externally generated from supplying metal vapor or nanoparticles from a nanoparticle generator.

17. A process as claimed in claim 1 wherein the catalyst is generated from nanoparticles of catalyst added to a liquid carbon precursor.

18. A process as claimed in claim 17 wherein the liquid carbon precursor is tetrachloroethylene.

19. A process as claimed in claim 4 wherein the nozzle is selected from water-cooled nozzles, ceramic coated nozzles and ceramic nozzles.